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This publication is to introduce vocational educators and others interested in occupational education to research and writings on the economics of vocational-technical education. Research pertaining to cost-benefit and cost-effectiveness analysis of vocational education and manpower training programs is emphasized. Major sections are devoted to a review of research and writings pertaining to the theory and concepts of the economics of education, the methodological and conceptual problems involved in evaluating vocational-technical education programs using cost-benefit and cost-effectiveness models, results of cost benefit and cost effectiveness studies of public school vocational technical programs and manpower training programs, and the use of followup studies as a means of evaluating vocational-technical education programs. Other sections deal with studies of costs and returns from investment in rural technical schools, investment effects of education in agriculture, and the relationship between vocational education and students' propensity to drop out of school. The author's conclusions and recommendations are included. Of the 100 sources cited, the oldest was published in 1962 and most were published since 1966. (AUTHOR/ET) -

RESEARCH 16

Review and Synthesis of Research on the Economics of Vocational Education

THE CENTER FOR VOCATIONAL AND TECHNICAL EDUCATION
THE OHIO STATE UNIVERSITY, 1900 Kenny Rd., Columbus, Ohio 43212

The Center for Vocational and Technical Education has been established as an independent unit on The Ohio State University campus with a grant from the Division of Adult and Vocational Research, U. S. Office of Education. It serves a catalytic role in establishing a consortium to focus on relevant problems in vocational and technical education. The Center is comprehensive in its commitment and responsibility, multidisciplinary in its approach, and interinstitutional in its program.

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2. To stimulate and strengthen state, regional, and national programs of applied research and development directed toward the solution of pressing problems in vocational and technical education;

3. To encourage the development of research to improve vocational and technical education in institutions of higher education and other appropriate settings;

4. To conduct research studies directed toward the development of new knowledge and new applications of existing knowledge in vocational and technical education;

5. To upgrade vocational education leadership (state supervisors, teacher educators, research specialists, and others) through an advanced study and inservice education program;

6. To provide a national information retrieval, storage, and dissemination system for vocational and technical education linked with the Educational Resources Information Center located in the U. S. Office of Education.

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
OFFICE OF EDUCATION

RESEARCH 16

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REVIEW AND SYNTHESIS OF RESEARCH ON THE ECONOMICS OF VOCATIONAL-TECHNICAL EDUCATION

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PREFACE

THE ECONOMICS OF VOCATIONAL AND TECHNICAL EDUCATION

In recent years nearly all facets of human endeavor have in varying measure come under the purview of program, planning, and budgeting systems. Within the educational arena, vocational education has been of special interest to economists. Vocational-technical education's objectives emphasizing occupational proficiency, its relationship to the labor market, and its concern for manpower projections are illustrative of some issues that make vocational-technical education particularly amenable to research having to do with the economics of education. While economists have begun only recently to study and conduct research on the economics of vocational-technical education, it appears that the findings of this research are now influencing, and are likely to influence to an even greater extent in the future, policy decisions concerning vocational-technical education.

Vocational educators must learn a new language if they are to be involved in many of the important policy decisions concerning vocational-technical education. This new language includes concepts and operations such as cost-benefit and cost-effectiveness analysis, systems analysis, and planning-programming-budgeting. A major purpose of this paper is to familiarize vocational educators with a part of this new language as it pertains specifically to vocational-technical education.

This paper has been developed as one of a series of information analysis papers developed and released by the ERIC Clearinghouse on Vocational and Technical Education. Scholars who wish to examine the primary sources of data covered in this review and synthesis paper are invited to utilize the bibliography and ERIC system. It will be noted that ED numbers are included for many bibliographical items.

We are indebted to Professor Robert Warmbrod who developed this paper while on sabbatic leave as associate professor of Vocational Education at the University of Illinois.

Robert E. Taylor, *Director*
The Center for Vocational and Technical Education
The Ohio State University

INTRODUCTION

The primary purpose of this paper is to introduce vocational educators and others interested in occupational education to research and writings on the economics of vocational-technical education. Concomitantly, the intent is to identify relevant issues and problems pertaining to research on the economics of vocational-technical education and to cite appropriate research and writings pertaining to these issues. A complete treatment of all issues and problems identified is not intended; however, the goal is to cite and review sufficient literature to allow the reader to study in detail the issues and problems that are germane to the topic. The paper is written as a secondary rather than a primary source document.

Emphasis throughout the paper is placed on the description, review, and synthesis of research and writings. Writings, primarily by economists, are reviewed which identify and describe a theoretical and methodological framework within which research on the economics of vocational-technical education can be conducted and evaluated. The methodology and findings of research on the economics of vocational-technical education are reviewed in detail. This approach--the outlining of a theoretical framework followed by descriptions of the methodology and findings of research--is chosen specifically to aid the reader in critically evaluating the research reported. In addition, published critiques of the research reviewed are cited.

The organization of the paper is designed to introduce the reader to the economics of education as it pertains specifically to vocational-technical education. The first section of the paper presents an overview to some of the major writings on the economics of education. In the following section the concepts and techniques of cost-benefit and cost-effectiveness analysis are described. Results of research using cost-benefit and cost-effectiveness models are presented in the next two sections of the paper. The concluding section includes a description of additional research relating to the economics of vocational-technical education.

Special appreciation is extended to the following persons who reviewed the paper and offered helpful suggestions: Dr. Jacob J. Kaufman, director of the

Institute for Research on Human Resources, Pennsylvania State University; Dr. Gordon I. Swanson, professor of education, University of Minnesota; Dr. William G. Loomis, state director of vocational education, Salem, Oregon; and Dr. Edwin L. Rumpf, chief, Development Branch, Division of Vocational and Technical Education, U. S. Office of Education. The author acknowledges also the suggestions and comments of the following staff members of The Center for Vocational and Technical Education, The Ohio State University, who reviewed the paper: Mr. Robert Young, specialist in economics; Dr. Joseph McGivney, specialist in planning-programming-budgeting; and Mr. William Nelson, research associate. The suggestions and comments made by reviewers were invaluable; however, the author assumes full responsibility for the contents of the paper.

Mrs. Suzanne O. Frankie, research librarian, and Mrs. Celianna I. Wilson, information services coordinator, both of The Center for Vocational and Technical Education were very helpful in locating and obtaining materials and in indexing the bibliography to the ERIC system. Their assistance is appreciatively acknowledged.

J. Robert Warmbrod

CONTENTS

SUMMARY

The primary purpose of the publication is to introduce vocational educators and others interested in occupational education to research and writings on the economics of vocational-technical education. Research pertaining to cost-benefit and cost-effectiveness analysis of vocational education and manpower training programs is emphasized. One hundred documents, written primarily by economists, are cited in the publication.

Major sections of the publication are devoted to a review of research and writings pertaining to the theory and concepts of the economics of education, the methodological and conceptual problems involved in evaluating vocational-technical education programs using cost-benefit and cost-effectiveness models, results of cost-benefit and cost-effectiveness studies of public school vocational-technical programs and manpower training programs, and the use of follow-up studies as a means of evaluating vocational-technical education programs. Writings are cited which critically evaluate the research cited and reviewed. The author's conclusions and recommendations constitute the concluding section of the publication.

The publication is written for persons actively involved in planning, conducting, and evaluating vocational-technical education programs. The publication is written specifically for vocational education researchers and for others interested in or conducting research pertaining to the economics of vocational-technical education.

REVIEW AND SYNTHESIS OF RESEARCH ON THE ECONOMICS OF VOCATIONAL-TECHNICAL EDUCATION

ECONOMICS OF EDUCATION

During the past decade the economics of education has been a topic of concern both to the theorist and the researcher in economics. The conceptual schemes and models of that theory and research provide the framework within which research pertaining to the economics of vocational-technical education will be evaluated and within which meaningful research on the ecoromics of vocational-technical education is likely to be conducted.

Hansen (1967) emphasized that the two basic questions underlying much of the research on the economics of investment in education have to do with how much more or how much less we should be investing in education in general and how much more or how much less we should be investing in specific types of education. Both issues are of concern to vocational-technical education, particularly the latter which has specific and direct implications.

We are experiencing a time when there are limits to the amount of public funds available for education while the demand for expenditures for education is virtually unlimited. Thus, the allocation of resources to education in general and to various types of educational programs specifically becomes a particularly crucial issue. Kraft (1968) maintained that research on the economics of education will be extremely influential as a basis for policy decisions that will guide education in the future. Weisbrod (1966b), listing education as the area of human resource development making the greatest and most rapidly climbing demands upon public funds, cautioned that choices concerning the allocation of resources are not likely to be wise choices when they are made without recognition of the benefits and costs of alternative uses of resources. He described education as the area of human resource development with both pressing issues of public policy and challenging opportunities for farsighted leadership.

Research and writings presented in this section of the report indicate general agreement with the position that education is a vital element in economic growth. However, the relative contributions of general

education and occupational (vocational-technical) education to economic growth and development have not been delineated clearly. Brandon and Evans (1965) pointed out the paucity of studies on the economics of vocational education yet, paradoxically, vocational education is usually justified on economic grounds. They challenged studies on the economics of education in which it is assumed that each school curriculum has the same economic utility.

The realization that investment in education contributes to economic growth has led to a new look at the interdependence of the educational system and the occupational structure of the labor force (Woodhall, 1967). The result is that educational planners and policy-makers now place more emphasis than before on estimates of future manpower requirements in determining the need for expansion in education and for the allocation of funds within education.

One implication is clear. The study of the economics of education has special relevance to vocational-technical education. It is crucial that the economics of education become, if it is not now, a primary concern of persons involved in planning, conducting, and evaluating programs of vocational-technical education. To aid in this effort, a general but brief overview of the research and writings on the economics of education is presented. That will be followed by a more extensive review of research specifically oriented to the study of the economics of vocational-technical education.

Economic Returns to Education

Education and Earnings--The research of economists has consistently shown a favorable relationship between an individual's educational attainment, subsequent income, and prospects for employment (Weisbrod, 1966b). The survey of findings on the economic returns to education by Innes, Jacobson, and Pellegrin (1965) included the following conclusions concerning the relationship of education and earnings: a.) for males at all age levels, annual income increases as years of schooling increase; b.) total lifetime income increases as educational attainment increases; c.) the favorable relationship between income and educational attainment has persisted through the years, even though the amount of formal schooling attained by the population has increased, and d.) when lifetime income is discounted or equated to return on current investment, the contribution of additional education to earnings is positive and significant.

Carol and Parry (1968) presented data challenging the idea that the more formal education an individual obtains the higher paying occupation he may enter and hence the greater his lifetime earnings. Calculating the present value or discounted net lifetime earnings of sixty-seven occupations from 1960 census data, they found the resulting ranking of occupations revealed that certain blue-collar occupations surpassed some of the managerial and professional occupations. Carol and Parry's (1960) interpretation was that it would be wiser in some cases for an individual to leave school earlier and invest his earnings during the years he would have been in school, together with the unused school expenses, in the capital market.

Sorkin (1968) used census data for 1940, 1950, and 1960 to investigate the association between education and men's average hourly wages. Excluding self-employed occupations, he used a linear regression model where average hourly wage was considered to be a function of the median years of schooling in an occupation. The resulting regression coefficients indicated an imperfect association between education and earnings. In 1940, almost 46 percent of the variation in occupational wages was explained by differences in years of schooling. In 1950 and 1960, 34 percent and 41 percent, respectively, of the variation in wages was explained by years of schooling.

Rate of Return on Investment in Education--The rate-of-return approach for assessing the economic returns to education involves the relationship between investment outlays and benefits. The present value of lifetime income differentials associated with various levels of education are calculated. These returns are then compared with the incremental costs of the different stages of education. Then, net returns from different types of education are compared (Benson, 1967; Hansen, 1967). Shultz (1967) pointed out that at the present time estimates of the costs of education are not as good as the estimates of earnings. But estimates of both costs of education and earnings from education are needed to calculate the rate of return.

Benson (1967) concluded that, in general, returns to education as seen from a societal point of view compare favorably with the yield of investment in physical capital. Innes, Jacobson, and Pellegrin (1965) found that education yields a high rate of return on investment both from the point of view of society as a whole and for the individual. Schultz (1967) cited evidence showing very high private rates of return to elementary schooling, high returns for high school,

and private rates of return to college education that are comparable to private rates of return on other private investment. Weisbrod (1966b) maintained that education is an investment which produces at least as great a financial return as investment in corporate enterprise.

Becker's (1964) early research revealed a rate of return to an average college entrant to be ten to twelve percent per annum. He found that the rate was higher to urban, white, male college graduates and lower to college dropouts, nonwhites, women, and rural persons. In assessing the relative importance of ability and education in explaining earning differentials between college and high school persons, Becker found that ability explained only a relatively small part of the differentials and that college education explained the larger part. Before adjusting for differential ability, Becker (1964) found estimates of private rates of return from high school education to be greater than the rates of return from college. He noted however that after adjusting for ability the returns from high school may not be greater than returns for college for ability apparently differs more between high school and elementary school students than between college and high school students. A similar qualification was suggested for the evidence indicating that the rates of return to elementary education are the highest of all (Becker, 1964).

Hanoch's (1967) more recent estimates of the private rate of return to educational investment revealed that the average rate for high school, relative to elementary school or high school dropouts, was sixteen percent for whites in the North and nineteen percent in the South. College dropouts, relative to high school graduates, showed marginal rates of return of seven and nine percent in the North and South, respectively. The completion of college, relative to college dropouts, showed rates of return of twelve and eleven percent. The average rate between college and high school was about ten percent for both the North and South. The returns to very low levels of education (elementary school) were extremely high primarily because of relatively negligible direct and indirect school costs at that level. Hanoch (1967) concluded that the marginal rates of return to investment in education revealed a downward trend, that is, the higher the amount of schooling the lower the marginal internal rate of return.

Schultz (1967) assessed the use of rates of return as a guide for allocating resources to education and for allocating resources within the educational sector.

He maintained that the question of efficient allocation of resources to education was important because education absorbs a large share of our resources so misallocations, within education and between education and alternative expenditures, could be wasteful. Although the responses of students (and parents) and the decision-making bodies that organize and operate schools to changes in rates of return have not been analyzed in a dynamic response model, Schultz (1967) contended that historical evidence indicates that such responses are occurring and that, in general, the responses are in the right directions.

Education and Economic Growth--Those who study economic development in the United States have concluded that education is a significant contributor to economic growth. Even though precise quantitative assessment of the relation between education and economic growth has not been found (Benson, 1967), planners and policy-makers are becoming more fully aware of the extent to which investment in education and training contributes to the process of economic growth (DeWitt, 1965).

The basic idea relating investment in education to economic growth is that education has positive effects on the development of human talent and the development of talent, in turn, has positive effects on economic growth (Kraft, 1968). Education produces a labor force that is more skilled, more adaptable to change, and more likely to develop imaginative ideas, techniques and products that are critical to the process of expansion, growth, and adaptation to change. So education by contributing to worker productivity is a process of investment in human capital (Weisbrod, 1966b).

Schultz (1963, 1967) stated that investment in schooling is a major source of human capital. Schultz (1963) differentiated the consumption component (immediate satisfaction that people obtain from schooling) and the investment component which includes future consumption and future producer capability. He maintained that contributions to schooling increases future productivity and earnings.

Denison's (1962) early study showed that increased education of the labor force contributed about twenty-three percent of the growth in total national income in the United States during the 1929-1957 period. The estimates by Schultz (1963) support Denison's conclusions. Schultz (1963) proposed two lessons that can be drawn from the studies of schooling as a source of economic growth. First, schooling has been a larger

source of growth during the last three decades (1930's through 1950's) than material capital represented by structures, equipment, and inventories. Second, the prospects are that during the next two decades schooling will continue to be a major source of economic growth, but beyond that time it will not be possible to continue increasing the capital stock of schooling at the rate which is now evident.

Tweeten (1967) supported the conclusion that education is a profitable investment for society in terms of economic growth. He questioned, however, whether investment in education has a profitable economic payoff for youth who remain in depressed areas. Tweeten (1967) suggested that investment in education is highly profitable to individuals in rural poverty areas who have geographic and occupational mobility and that investment in education is likely to be only marginally profitable to those persons lacking mobility.

External Benefits of Education--Most of the research pertaining to the economic benefits to education are based on the assumption that all the benefits of education are captured by the recipient and that none of the benefits of the recipient's education improves the well-being of his neighbors, his employer and co-workers, or society in general (Schultz, 1963). Weisbrod's (1964) research revealed, however, that there are benefits from education to people other than the immediate recipients of that education. Benefits to persons other than the immediate recipient and to persons other than those in the school district in which the education is provided are referred to as external benefits of education.

Weisbrod (1964) categorized persons receiving external benefits from a student's education into three groups: a.) residence-related beneficiaries who benefit by virtue of some relationship between their place of residence and the place of residence of the recipient of education. Within this category are included the current family of the student, the future family of the student (intergenerational benefits), neighbors, and taxpayers both in the immediate community of the student and in other communities; b.) employment-related beneficiaries who benefit by virtue of some employment relationship with the recipient of education; and c.) society in general. Weisbrod's case study of the external benefits to elementary and secondary education in one school district showed that it was not possible to develop monetary measures of all external benefits to education. The case study did reveal, however, that the school district was a net exporter of

benefits to some areas and a net importer from other areas. Weisbrod (1964) concluded that education in one school district benefits other areas, and that there is no necessity for the benefits from and to any particular community to be equal.

Writings on the Economics of Education

Blaug (1966) and Deitch and McLoone (1966) compiled extensive bibliographies on the economics of education. Kraft (1968) reported the proceedings of the first annual conference on the economics of education held at Florida State University in 1967. Hansen (1967) edited a report of a symposium on rates of return to investment in education.

Hansen and Weisbrod (1967) compiled a report of a seminar-workshop on the economics of education and human resources held at the University of Wisconsin. Correa (1967) discussed the concepts involved in measuring the contribution of education to economic growth and the accompanying policy implications.

Tweeten (1967) reviewed research findings pertaining to the economics of education with special reference to education and earnings in rural areas. Benson (1967) and Woodhull (1967) prepared reviews of research on the economics of education that have appeared in the Review of Educational Research. Innes, Jacobson, and Pellegrin (1965) summarized the findings of economists concerning education as an investment.

BENEFITS AND COSTS OF VOCATIONAL-TECHNICAL EDUCATION

Research on the economic aspects of vocational-technical education has accompanied the emphasis being placed on the study of the economics of education in general. Since one of the primary purposes of vocational-technical education is preparation for employment, vocational-technical education is, in some respects, more amenable for an economic assessment of benefits than is education in general.

As with many public social programs, vocational-technical education is being subjected to rigorous economic analysis which necessitates that costs and benefits, both monetary and nonmonetary, be quantified. The assertion is that vocational-technical education programs should be required to meet the test of economic efficiency and that alternative methods for achieving the objectives of vocational-technical education should be identified and compared in terms of costs and benefits

both to each other and to present programs. The concern includes not only the efficient use of resources allocated to vocational-technical education but also a consideration of alternative programs to which present and/or additional funds could be allocated for accomplishing the objectives set forth for vocational-technical education. It is imperative that costs of vocational-technical programs be justified on the basis of outcomes. Indirect measures of the economic utility of vocational-technical education--percentage of graduates employed, percentage of graduates working in occupations for which prepared, and similar measures--are inadequate and incomplete measures of the economic benefits of vocational-technical education.

This section of the report deals with the approaches and techniques being proposed and used for measuring the benefits and costs of vocational-technical education. Cost-benefit and cost-effectiveness analysis will be explored. The use of rate of return and present value of net returns will be mentioned as techniques for evaluating the effectiveness of vocational-technical education. The following section of the report will include a review of the major studies reported to date that have employed the aforementioned techniques in studying the economics of vocational-technical education.

Cost-Benefit Analysis

Cost-benefit analysis is an evaluative technique that relates total value of benefits of a program to the total costs of the program. Cost-benefit analysis, first used to assess costs and benefits of natural resource development projects, has as its main concern the optimum allocation of resources (Kaufman, Stromsdorfer, Hu, and Lee, 1967). Cost-benefit analysis is one of the new methods designed to help decision-makers maximize benefits for a given level of costs or to minimize costs for a given level of benefits (Kotz, 1967a; 1967b).

James (1968) explained that the purpose of cost-benefit analysis is to find a way to give the highest net value to benefits after all costs are deducted. He characterized cost-benefit analysis as one component in a hierarchy of new methods of analysis available to the decision-maker. Other components of the hierarchy of new methods identified by James (1968) were system analysis and planning, programming, and budgeting systems (PPBS). Hatry and Cotton (1967) and Hatry (1967) have outlined the purposes and operation of PPBS indicating the role of cost-benefit and cost-effectiveness analysis in a system of planning, programming, and budgeting.

The application of cost-benefit analysis to vocational-technical education requires that benefits

as well as costs be expressed in monetary terms. Benefits that cannot be expressed in monetary terms cannot be included in the analysis. Spiegelman (1967) pointed out that benefit-cost analysis of vocational-technical education programs permits the assessment of a particular program or project (Does the sum of the benefits of the program or project exceed the sum of the costs?) in addition to permitting comparisons of specific programs or projects (How do the costs and benefits of one program or project compare to the costs and benefits of other programs?).

Identification of Costs and Benefits--The first step in the application of cost-benefit analysis to vocational-technical education is the identification of the costs and benefits of a given program. Both individual and social costs must be quantified in monetary terms, an accomplishment that is termed virtually impossible by Kaufman et al. (1967). Mangum (1967) contended that many of the benefits and some of the costs of social programs are non-quantifiable, thereby leaving broad areas of assessment to assumption and judgment.

Individual or private benefits have been defined as the welfare gained by an individual as a result of education. Davie (1967, 1968) listed the following as individual benefits: a.) additional earnings attributable to vocational-technical education net of taxes; b.) fringe benefits associated with additional earnings; c.) stipends received, if any, while enrolled in a vocational-technical program; d.) value of the option to enter other educational programs in the future; and e.) increased psychic income. Benefits to society or welfare gained by society as a result of education were listed as the gross additional earnings of individuals attributable to vocational-technical education, the effects of reducing transfer payments, and better citizenship and reduced costs to society of bad citizenship.

Hardin (1967) defined social costs as the value of the productive resources used up by providing an educational program. The resources include instructional resources; administrative resources; additional resources used by trainees because of training, e.g., travel expenditures of trainees; and opportunity costs of foregone earnings of trainees due to the fact that the productive manpower of trainees is not available to society while the training course is in progress. Stromsdorfer (1967) argued that within the context of vocational education the treatment of costs in a cost-benefit model requires a generalized concept of costs. That is, all costs should be viewed as opportunity costs

for the costs of training students in a given skill are the foregone opportunities resulting from the fact that resources used in the training effort cannot be used elsewhere. Stromsdorfer (1967) listed the following types of costs that should be considered: a.) current costs including items such as teachers' salaries, heat, light, and costs from nonschool system support; b.) capital costs for both physical plant and instructional equipment; c.) cost correction factors to adjust for the fact that nontaxed public resources will buy more goods and services in the market place than taxed private resources; and d.) foregone earnings of students. Private or individual costs of participating in a vocational-technical program are usually categorized as foregone earnings of students and additional expenses incurred due to attending school such as tuition, books, and transportation (Davie, 1967, 1968; Kaufman et al., 1967).

There is not agreement among economists conceptually or operationally concerning what constitutes social costs when cost-benefit analysis is applied to programs of vocational-technical education. Persons contemplating research pertaining to cost-benefit analysis of vocational-technical education should review the following references for a critique of what should and what should not be included in a calculation of social costs of providing programs of vocational-technical education: Davie, 1967, 1968; Hardin, 1967; Kaufman, et al., 1967; Stromsdorfer, 1967.

Economists who have conducted cost-benefit studies of vocational-technical education report that the cost data available are highly inadequate (Kaufman, 1967). Dueker and Altman (1967) studied sixteen comprehensive and sixteen vocational schools to identify the kinds of costs and related data that could be obtained to aid in planning and evaluating programs of vocational education. They found that the available cost data do not readily lend themselves to coherent analysis and that cost data pertaining to vocational education are not kept in a way that makes them accessible for rigorous analytic and evaluative purposes. Dueker and Altman (1967) concluded that data are not easily obtained for realistic cost-effectiveness studies of vocational education. Anderson's (1966) pilot study of junior colleges in four states resulted in a design for determining the differential costs of vocational-technical curricula in comprehensive junior colleges. The cost-analysis design developed yields costs per full-time equivalent student for general and vocational-technical courses. The components of cost included in Anderson's (1966) design are administration, instruction, operation and maintenance of plant, auxiliary and community services,

equipment, and capital outlay. Drouet (1968) suggested a method for the analysis of instructional costs of vocational training.

Conceptual and Methodological Problems--As the preceding indicates, there are many conceptual and practical problems involved in the application of cost-benefit analysis to vocational-technical education. It is imperative that persons contemplating research in this area become familiar with the issues and problems discussed by the writers cited below.

Davie (1965) and Kaufman et al. (1967) emphasized that basic to cost-benefit analysis is the concept that comparisons between programs must be on the basis of marginal or additional costs and benefits. Specifically applied to vocational-technical education this means that comparisons between vocational education and academic education must be based on the extra costs of training youth in the vocational curriculum and the extra benefits accruing to students in the vocational curriculum.

A very difficult problem is that of estimating the effects of training for a particular training program. Hardin (1967) stated that the effects of training on output variables cannot be estimated quantitatively and with a great deal of accuracy unless a control group design is used in the analysis. He maintained that the best design is to compare the output variables of trainees with those of comparable nontrainees. Stromsdorfer (1967) and Weisbrod (1966a) pointed out the conceptual problems associated with a control or comparison group. Of particular importance is the fact that the study group and the comparison group will usually have different socio-demographic characteristics and different values, motivations, and other characteristics that affect their labor market experience after completion of a training program. Stromsdorfer (1967) pointed out that statistical techniques can help control the differences between the study and comparison groups but that the different patterns of interaction between variables and within the two groups can never be completely controlled. Hardin (1967), Stromsdorfer (1967), and Weisbrod (1966a) discussed the conceptual issues involved in measuring benefits of occupational education programs. The studies by Kaufman et al. (1967) and Carroll and Inhen (1966, 1967) should be consulted for a further discussion of these issues and for illustrations of how the issues were dealt with in specific research studies.

Discounting Costs and Benefits--Following a quantification of both costs and net benefits in monetary terms,

the next step in cost-benefit analysis is the discounting of future costs and benefits to a stream of annual benefits and costs of the program. As Davie (1965) and Hardin (1967) pointed out, both costs and benefits of a training program occur over a period of time, hence each must be converted to apply to a particular point in time. These converted values, referred to as the present value of costs and benefits, are calculated by discounting the future benefits and costs back to a selected point in time with a chosen rate of discount. The discounted benefits and discounted costs are then summed to obtain the present value of benefits and present value of costs which will be compared by the benefit-cost ratio. The choice of an appropriate rate of discount for use in evaluating educational programs is an issue that should be studied carefully by those contemplating cost-benefit analysis research. Discussions of this issue can be found in Kaufman et al. (1967), Hardin (1967), Stromsdorfer (1967), and Davie (1965, 1967, 1968).

Benefit-Cost Ratio--The benefit-cost ratio equals the present value of net benefits divided by the present value of costs. Given the methodology and other assumptions and limitations involved in cost-benefit analysis, the decision rule is as follows: When the benefit-cost ratio exceeds unity, the corresponding activity is economically superior to an alternative activity with a lower benefit-cost ratio. If purely economic efficiency criteria are to be used in determining the investment decision, then the projects or programs chosen first should be those having the highest benefit-cost ratios. Similarly, projects or programs having benefit-cost ratios less than one should not be undertaken (Davie, 1965, 1967, 1968; Hardin, 1967). Both Davie (1967, 1968) and Hardin (1967) cautioned, however, that the decision-maker may elect to consider additional criteria of a non-economic nature in the decision-making process. Hardin (1967) differentiated between benefit-cost ratios that may be calculated for society in general, for a particular government agency, and for individual participants in an educational program.

Limitations of Cost-Benefit Analysis--As the foregoing indicates, there are several problems and limitations in evaluating programs of vocational-technical education through cost-benefit analysis. Kaufman et al. (1967) cautioned that cost-benefit analysis has disadvantages when applied to programs of education. Davie (1965) listed the following limitations of cost-benefit analysis when applied to educational programs: a.) the treatment of benefits which cannot be measured in monetary terms; b.) the

comparison of monetary benefits among different individuals; c.) the search for the best possible programs; and d.) the treatment of benefits which accrue outside a particular community. Kaufman (1967) listed the problems and limitations of cost-benefit analysis as including the following questions: What costs and what benefits are to be included? How are costs and benefits to be valued? At what interest rate are costs and benefits to be discounted? What are the relevant constraints? Dueker and Altman's (1967) analysis of thirty-two schools concerning the availability of cost and performance data pertaining to vocational education revealed that an organized body of performance data did not exist and that available cost data were not readily adaptable to analysis.

Rate of Return and Present Value of Net Returns

In addition to the benefit-cost investment decision rule, two alternative evaluative criteria are mentioned by writers for making choices between alternative investments in vocational education and other types of education. Each of these evaluation techniques requires that both costs and benefits be quantified in monetary values. The "present value of net benefits" decision rule specifies that investment should be made in a given activity if the sum of discounted benefits less discounted costs is equal to or greater than zero (Stromsdorfer, 1967). The "internal rate of return" decision rule specifies that a given activity should be carried out when the rate of discount that makes the discounted benefits minus discounted costs equal to zero is equal or greater than some specified rate (Stromsdorfer, 1967).

Davie (1967, 1968), Kaufman et al. (1967), and Stromsdorfer (1967) describe and discuss the relative merits of these investment criteria in relation to the benefit-cost ratio. Davie (1968) stated that in most cases the ratio of benefits to costs is the most appropriate criterion to use in planning and evaluating vocational-technical education programs.

Cost-Effectiveness Analysis

Given the conceptual and practical constraints on the application of cost-benefit analysis to educational programs, economists propose that cost-effectiveness analysis is the more appropriate technique for the objective evaluation of vocational-technical education (Hardin, 1967; Kaufman et al., 1967). Cost-effectiveness analysis of education is a methodological framework for making

numerical estimates of the effects of particular training activities on selected output variables and the estimates of the costs of obtaining these effects.

Measuring Benefits--In cost-effectiveness analysis, output variables serving as indices of benefits of specific programs are retained in their raw form. The outputs need not be economic in nature and do not have to be expressed in monetary terms (Hardin, 1967; Kaufman et al., 1967). Hardin (1967) listed one group of output variables that pertain to the trainee's performance at the end of training. Examples of these types of variables include the trainee's knowledge, skills, motivation, and other behaviors that may be measured by direct observation or by oral or written tests.

A second group of output variables listed by Hardin (1967) refer to the trainee's labor market performance. Illustrations of these types of benefits include annual earnings (hourly earnings and annual hours worked), employment stability, labor force participation, skill level of regular job held, degree of utilization of training knowledge and skills in employment, receipt of unemployment insurance benefits or welfare assistance, and geographic mobility. The issues and problems of estimating the effects of training on the output variables (e.g., the necessity for a control group design and the selection of appropriate comparison groups) encountered in cost-benefit analysis are equally applicable to cost-effectiveness analysis.

Effectiveness-Cost Ratio--The outcome of cost-effectiveness analysis is a statement concerning the effect that a particular activity has on selected output variables and on the cost of the same activity. The statement may be of the form of a ratio or of a form that specifies certain effects associated with the costs of the program (Hardin, 1967). It should be emphasized that the application of cost-effectiveness analysis does not require that costs of a program be related to its output variables. Kaufman et al. (1967) proposed that it may be useful to study separately costs of vocational programs from the outputs of vocational programs. An obvious advantage of cost-effectiveness analysis, over cost-benefit analysis as a technique for evaluating vocational-technical education, is that it avoids the restriction which requires that all benefits be quantified in monetary terms.

Writings on Cost-Benefit and Cost-Effectiveness Analysis

Prest and Turvey (1965) discussed the conceptual and methodological problems involved in the application

of cost-benefit techniques in a variety of fields including education. This article includes a discussion of the strengths and weaknesses of cost-benefit analysis as an aid to decision-making. Although not related specifically to education, this reference is helpful in understanding the concepts of cost-effectiveness analysis.

Pearman (1966) prepared a bibliography of research and writings pertaining to cost-effectiveness analysis, cost-benefit analysis, and planning-programming-budgeting. A portion of the bibliography lists research and writings pertaining to education. Case and Clark's (1967) bibliographic guide to operations analysis of education includes references relating to cost-effectiveness and cost-benefit analysis. The paper on cost-benefit analysis of education by Mood and Powers (1967) should be reviewed by persons undertaking research on the economics of vocational-technical education. Abt Associates (1967a, 1967b) and Spiegelman (1967) designed cost-effectiveness and cost-benefit models for evaluating elementary and secondary education programs.

Davie (1965) prepared an early paper which explored the application of cost-benefit analysis as an aid in planning and evaluating vocational education. A major purpose of the study by Kaufman, Stromsdorfer, Hu, and Lee (1967) was the development of a methodology for conducting an empirical investigation of the costs and benefits of vocational education. The preliminary report of that study is an excellent reference concerning the conceptual and methodological problems and limitations of the application of cost-benefit and cost-effectiveness techniques to vocational-technical education. The two volumes edited by Kotz (1967a, 1967b) report the proceedings of a conference on vocational-technical education conducted by the Stanford Research Institute. The reports of this conference on new approaches to planning, programming, budgeting, and evaluation include papers that will be valuable to persons planning and conducting cost-benefit and cost-effectiveness studies in vocational-technical education. Somers (1968b) edited the proceedings of a 1967 conference on vocational education which was sponsored by the Brookings Institution. The papers presented at the conference pertained to conceptual issues and research relating to the economics of vocational education.

REPORTS OF RESEARCH: PUBLIC SCHOOL VOCATIONAL-TECHNICAL EDUCATION

Conflicting conclusions have been drawn from the research reported to date which deals with the economic aspects of vocational-technical education in the public schools. Kotz (1967b) stated that most studies indicate that at the secondary level vocational education costs about twice as much as other secondary education, yet the monetary benefits are similar for the major secondary curricula. He concluded that if monetary benefits are accepted as a proper performance index and if vocational education and other secondary education are close substitutes for each other, then educational resources are being badly allocated both from society's and the individual's viewpoint. Kotz (1967b) raised the question whether greater monetary benefits could be gained by shifting resources away from vocational education in high schools to other types of education. Alternative programs mentioned were academic programs or work-study programs using the capital facilities of employers. Kotz (1967b) pointed out that the few benefit-cost studies on vocational education that have been reported suffer from a variety of data and methodological shortcomings which limit their generality.

Conversely, the Advisory Council on Vocational Education (1968a) concluded that studies relating the costs of vocational education to the benefits derived from vocational education have given it solid support. The Advisory Council pointed out that when controlled for differences in ability, vocational students profit substantially as compared to others in both employment and earnings.

Research which utilized cost-benefit and cost-effectiveness models in assessing the effectiveness of vocational programs in public schools will be reviewed in this section of the report. Research pertaining to the economic aspects of manpower training and retraining programs will be reported in the succeeding section of this report.

Costs and Benefits of Vocational Versus Academic Education (Kaufman, Stromsdorfer, Hu, and Lee, 1967)

The purposes of this study were twofold: a.) to develop a methodology for conducting an empirical study of the costs and benefits of vocational education and b.) to conduct an empirical study which allowed the drawing of conclusions about the efficiency of

vocational education. The main concern in the empirical study was a comparison between the academic and vocational-technical curricula in secondary schools. The study involved the collection of data from 1,148 non-college at ending graduates of vocational-technical and academic curricula in two cities.

The preliminary report of this study (Kaufman et al., 1967) includes a discussion of the conceptual and methodological problems involved in the application of cost-benefit and cost-effectiveness analysis to vocational-technical education in addition to the tentative findings of the empirical study. The data presented in the preliminary report deal only with social costs and benefits (private costs and benefits are not treated). Also, nonmonetary social benefits are not dealt with. The labor market experience of non-college attending graduates during the years 1955-56 through 1959-60 is analyzed in the report.

The major independent variable investigated in the study was the influence of the high school curriculum on the labor market performance of non-college attending graduates. The curricular patterns investigated were academic or college preparatory, general, vocational-academic, vocational-comprehensive, and vocational-technical. Socio-demographic variables that might influence the indices of labor market performance built into the design as independent variables included sex, race, intelligence quotient, marital status, and father's education as a measure of socio-economic status and background. City of graduation was treated as an additional independent variable to control for differences in the education institution structure and for differing industrial and labor market structures, price levels, employment differentials, and related factors. Multiple regression analysis was used to assess the relationship of the independent variables on the labor market experience of the vocational and academic graduates.

The indices of benefit used in the study were the graduates' money earnings and the percentage of time they were employed out of the total time which could be devoted to civilian labor force participation during the six-year period included in the study. The specific dependent variables were: a.) percentage of time employed in the six-year period, b.) average monthly earnings before taxes for the six-year period following graduation, c.) percentage of time employed the first year following graduation, d.) percentage of time employed the sixth year following graduation, e.) percentage point difference in the time employed between the first and sixth years, f.) average monthly

earnings before taxes the first year after graduation, g.) average monthly earnings before taxes the sixth year after graduation, and h.) differences in average monthly earnings before taxes between the first and sixth years.

Costs reported in the preliminary report included current costs only. Capital costs were not included. Since the theoretical criteria for the allocation of investment funds among different curricula require the use of marginal costs in order to make meaningful generalizations, marginal costs of the vocational-technical curriculum and the non-vocational-technical curriculum were calculated using the least-squares technique.

The general findings of the study indicated that in terms of employment and money earnings, vocational-technical graduates on the average fared better than non-college attending academic graduates over the six-year period. The multiple regression analysis which permitted a controlled estimate of the influence of curriculum revealed that vocational graduates had higher average monthly earnings, had more rapid increases in earnings, and were employed a greater proportion of the time they were available for employment than were the non-college attending academic graduates.

A calculation of investment criteria indices indicated the following: a.) the average present value of marginal benefits for each graduate of the vocational-technical curriculum was $2,491 and $1,965 discounting at six percent and ten percent interest rates, respectively. The average present value of marginal costs for each graduate of the vocational-technical curriculum was $1,478 and $1,375 discounting at six percent and ten percent interest rates, respectively; b.) the benefit-cost ratio (discounted marginal benefits divided by discounted marginal costs) was 1.7 when the six percent interest rate was used for discounting and 1.4 when the ten percent interest rate was used; and c.) the internal rate of return to the vocational curriculum, calculated for one city only, was twenty percent. The authors advised that caution should be observed in the interpretation of these measures for the monetary measures were an incomplete index of costs and benefits and the measured monetary costs and benefits themselves were incomplete.

The authors of the research report concluded that the vocational-technical curriculum is an economically efficient investment. They reported that the evidence suggests that funds should be shifted from the academic toward the vocational-technical curriculum.

The salient findings of this study have been reported elsewhere by Kaufman (1967, 1968). Law (1968) also reported the findings of this study.

Case Studies of Benefits and Costs
(Corazzini, 1966; Taussig, 1968)

Corazzini's (1966) study of the school system in Worcester, Massachusetts, was undertaken with a view toward presenting an overall economic evaluation of the vocational schools within the system. The study attempted to assess the economic benefits of the vocational schools to the individual and to the local community, and to compare the economic benefits with direct, indirect, and opportunity costs of maintaining the school. The community's regular high schools were compared with its vocational high schools with particular attention paid to the relative costs of the two programs. Comparisons were also made between graduates of high school vocational programs and graduates of post-high school vocational programs.

Corazzini (1966) reported that public per pupil costs of vocational education for males, whether at the high school or post high school level, were 2.3 times greater than the public per pupil costs for regular high school programs. The per pupil costs for vocational education for females was 1.8 times that of regular high school programs for females. When private direct costs were added, vocational education was 2.15 and 1.75 times that of regular high school programs for males and females, respectively. When private opportunity costs in the form of foregone earnings were added to public and private costs, the cost ratios were reduced such that vocational education for males was 1.40 times as expensive as regular high school education and vocational education for females was 1.25 times as expensive as regular high school education.

The benefit index used in the study was starting wages. A comparison of the starting wages of vocational school graduates with the starting wages of graduates of the regular high school programs revealed that initially vocational graduates earned slightly higher wages than untrained regular high school graduates. This finding was the case when vocational school graduates employed in jobs in the trade areas for which they were trained were compared with regular high school graduates who were employed in these same trade areas. The size of the premiums paid the vocational school graduate relative to the regular high school graduate varied inversely with the size of the firm in which the graduates were employed.

Corazzini (1966) argued that the starting pay differentials between vocational graduates and regular high school graduates would very likely decrease over time. He suggested a time period of five years stating that within that period of time regular high school graduates would have acquired at least as much on-the-job training as the vocational graduate, hence the initial advantage enjoyed by the vocational graduate would be lost. Given the initial wage differentials, all calculations allowing these differentials to decrease which also required that the present values of the extra costs and benefits be equated by the time the differentials became zero, resulted in a number of years which prohibited the recovery of the extra costs of vocational education. Starting salaries for post-high school vocational-technical graduates were, on the average, only slightly higher than the high school vocational graduates. The wage premiums paid post-high school vocational-technical graduates were not found to be large enough to justify investing in post-high school vocational education.

Corazzini's (1966) conclusions include the following: a.) given the cost of vocational education, it appears that alternative programs for publicly subsidized on-the-job training should be considered and b.) when vocational education is considered as a dropout prevention measure, excessive costs are still encountered with the consequence that direct income benefits resulting from graduating from high school rather than dropping out are not enough to justify expensive vocational programs. Corazzini stated that vocational education in the school system studied was an expensive terminal training program. He concluded the report by questioning the economic value of the vocational education program. Corazzini (1967) qualified some of his conclusions in a later presentation. This research was also reported by Corazzini (1968) at a conference on vocational education sponsored by the Brookings Institution.

Taussig (1968) used a cost-benefit framework for a case study of vocational education in New York City. He stated that measurement of the cost of the high school vocational program was not free of serious difficulties but that the more significant problems of concept and measurement had to do with the benefits of vocational education. Earnings data for graduates and data indicating the immediate employment experience of vocational school graduates used in the study were data collected annually by the schools by means of a postcard questionnaire sent out approximately four months after graduation.

When vocational school graduates of 1963 were compared with academic high school graduates for the same year, Taussig (1968) reported that vocational school graduates had a significantly lower rate of unemployment than academic high school graduates, 10.5 percent and 17.6 percent unemployed, respectively. After noting the difficulties encountered in using raw data when making comparisons between vocational and academic graduates, he concluded that the data on unemployment were suggestive rather than conclusive in that sharp differences in important group characteristics obscure the true relationship between vocational training and unemployment data.

Using earnings data revealed by the annual postcard surveys of vocational graduates, Taussig (1968) found that after making allowances for differences in estimation procedures and for variations in age, race, and experience, the initial earnings of vocational school graduates indicated that their skills did not command a significant premium in the labor market. Recognizing that further research may alter the conclusions reached, he concluded that the presently available research indicated that the direct market benefits from high school vocational education in New York City were disappointing. On the cost side, Taussig's estimates showed that the annual per capita cost of a student in the vocational program was some $500 more than the corresponding figure for a student in the academic high schools. He pointed out that this finding does not necessarily imply, however, that the incremental cost of transferring an additional student from the academic schools to the vocational schools is $500.

Taussig (1968) stated that in this study a numerical cost-benefit ratio would give false precision to the incomplete data that were available. When comparing the costs and benefits, he concluded that the evidence suggested that returns were meager relative to the considerable investment in vocational education in New York City.

Fein (1968) reported the following conclusions from Corazzini's and Taussig's research: a.) both found vocational education to be relatively expensive, b.) neither found significant differential wage rates in entry jobs for people with and without vocational education, c.) both found major rigidities in vocational education, and d.) both researchers agreed that there were statistical and conceptual problems to be resolved and that there were major gaps in the data used in each study. Fein (1968) summarized the comments of discussants of the papers presented by Corazzini and

Taussig at the 1967 Conference on Vocational Education sponsored by the Brookings Institution. Included in this summarization is a number of points needing further analysis and elaboration which were raised by the discussants.

Kaufman et al. (1967) presented an extensive critique of Corazzini's and Taussig's research. Davie (1967, 1968) reviewed Corazzini's research. Both Kaufman and Davie paid particular emphasis to the methodological and conceptual deficiencies of the studies. Law (1968) and Schaefer (1967) have also prepared reviews of Corazzini's research.

Costs and Returns for Investments in Technical Education (Carroll and Ihnen, 1966, 1967)

This study was conducted to estimate costs and returns for investments in two years of post-secondary technical education by a group of North Carolina high school graduates. Costs and returns estimates were used to evaluate the investments in technical education in total returns, total and private rates of return, and additions to the stock of human capital.

Income data for the study came from two groups. One group had completed two years of post-high school technical education; the other group had not completed formal schooling or occupational training since graduation from high school. To measure the income effects of post-secondary technical education, the incomes earned by 45 graduates of Gaston Technical Institute, North Carolina, were compared with the incomes of a group of 45 high school graduates. Each person in the post-high school group was paired with a high school graduate in the comparison group who had a similar academic record in the same high school and graduating class. This procedure made it possible to compare the technical education graduates with a group of high school graduates of comparable academic ability and geographic background. Regression analysis was used to standardize further the differences in income between high school and technical graduates for sources of variation in the quality of home and community environment, academic performance in high school, civilian and military experience, and investments in migration. Income data were collected from both groups over a period of seven years beginning at the time the post-secondary graduates entered the formal program of technical education. The total cost of post-secondary technical education was obtained by adding the costs borne by the student, including foregone earnings, and by his family and private

nongovernmental organizations to the public (government) costs of providing post-secondary technical education.

Technical education graduates earned an average of $573 more than high school graduates during the first year after completing the technical education program. Average monetary returns to technical education the first year following graduation were estimated to be $555 after adjustments were made to exclude income differences caused by factors other than schooling. The average monetary returns for technical school graduates increased by $161 per year during the first four years following graduation such that in the fourth year the technical school graduates had an estimated income average of $1,038 attributable to post-secondary technical education. In addition, the technical school graduates had many advantages in fringe benefits such as a shorter workweek, more paid vacation, holidays and sick leave, greater amounts of insurance benefits, and increased retirement benefits. A monetary value of $466 annually was estimated for fringe benefits.

Two projections were made of the future returns to be received by the technical education graduates. For the first projection the income advantage earned by technical education graduates in the fourth year after graduation, including the value of fringe benefits, was projected to retirement age of 65. The investigators called this a conservative estimate of the future returns to technical education graduates for they thought it unlikely that incomes of high school graduates and post-secondary technical school graduates would increase by equal dollar amounts over time. The second projection, labeled as less conservative by the investigators, was based on 1960 census data and assumed that the future income advantage of technical school graduates would increase until retirement age of 65.

The rate of return calculated on the total investment in two years of post-secondary technical education was 16.7 percent for the first projection and 20.1 percent for the second projection in which salary differentials increased over time. Since private costs were less than total costs, the estimated private rate of return was 23.9 percent for the first projection and 25.9 percent for second projection.

This study has been reviewed by Davie (1967, 1968) and Law (1968).

Costs and Returns from Investment in Rural Technical Schools
(Pejovich and Sullivan, 1966)

In this study the investigators sought to establish a basis for evaluating the private and social costs and returns accruing from investment in rural technical schools. Data used in the calculations were supplied by graduates of the Winona (Minnesota) Area Technical School from 1960 through 1965 and by all students enrolled in 1965. Questionnaire data were supplied by 359 graduates and students.

Private and social rates of return were calculated for the following instructional programs: auto mechanics, auto body repair, machine tool and die making, highway technician, welding, industrial electronics, general office clerk, stenography, and practical nursing. The investigators reported that the calculated median private rates of return on investment in the educational programs were above or about equal to the average rates of return an individual could expect to receive from other forms of investment. The median social rates of return calculated for the various curricula revealed that the social rates of return were sufficiently high relative to the average rates of return from other types of investment. The investigators concluded that the technical school was using resources allocated to it efficiently and profitably and that the use of the same resources elsewhere could not be expected to provide the community with a higher rate of return.

Investment Effects of Education in Agriculture
(Persons, Swanson, Kittleson, and Leske, 1968a)

This study assessed the returns to investments in farm business management education for adult farmers. The farm business management programs were conducted through vocational agriculture departments in the public schools of Minnesota. The study was designed to provide answers to the following questions: What benefits can accrue to farm families who choose to participate in an intensive educational program intended to improve their technical competence and management skills? What benefits accrue to the community that chooses to support such a program? What are the benefit-cost ratios of such an educational program when calculated for the individual participant and for the community?

The records of farmers who had been enrolled in vocational agriculture farm business management programs since 1959 were used in the study. The

sampling unit for the study was a "completely analyzed annual farm record" not an individual farmer. A total of 1,475 completely analyzed annual farm business records was used in the study.

The criterion variables used to calculate the return to individuals and to the community were operator's labor earnings, return to capital and family labor, and total farm sales. The effects of price level variations and other economic factors were minimized by calculating index values for the various measures of economic returns. The relationships of the criterion variables to the instructional program were expressed by a series of performance curves calculated by the technique of curvilinear regression. The general form of the performance curves showed a rising return to educational input during the first three years of the instructional program, a decline during the fourth and fifth years, and a sharply rising slope beginning with the sixth or seventh year of the instructional program.

In calculating benefit-cost ratios, marginal benefits were calculated as the sum of differences between the labor earnings and total farm sales reported by farmers with two, three, or more years of instruction in comparison to earnings of farmers who were analyzing a farm business record for the first time. This procedure was based on the assumption that benefits accruing to farmers during their initial year of enrollment were not due to farm management instruction.

Costs to farmers for the instructional program included opportunity costs (foregone earnings) for time spent in attending group and individual instruction and for the additional time needed for keeping the detailed farm records required by the instructional program. Costs to farmers also included direct costs for class purchases, transportation to class sessions, and a record analysis fee. Community costs included the opportunity and direct costs of farmers plus capital costs and direct community costs for the salaries of instructors, instructional materials, fuel and electricity, and related items.

Individual and community costs and individual and community marginal benefits were discounted to a present value for calculating benefit-cost ratios. All benefit-cost ratios were calculated from data covering a span of eight years.

The benefit-cost ratio for individual participants over the eight-year period was 4.2. For each dollar

invested in the farm business management instructional program by the farmer the return to his labor and management was $4.20. When community benefits were assumed to be the total benefits of the individual participants, the community benefit-cost ratio was 2.0. When total farm sales were used as a measure of community benefits, the benefit-cost ratio increased to 9.0.

Summaries of this study have been reported by Persons, Swanson, Kittleson, and Leske (1968b) and Persons (1968). In an earlier related study, Cvancara (1964) compared a group of 33 farm units which participated in the Minnesota farm management program in 1960, 1961, and 1962 with a matched group of 33 farm units which received farm management instruction in 1962 but not in 1960 and 1961. The farm units included in the study represented 20 communities in Minnesota. Cvancara (1964) found that farmers receiving farm management instruction for the entire three years had higher farm incomes by at least $500 over those farmers who received instruction only during the third year. Rolloff (1966) studied the records of 27 farm operators participating in farm business analysis programs in five Ohio schools to determine the economic returns accruing to the participants as a result of instruction. Economic returns were measured as ratios between 1965 program inputs (determined by hours of instruction) and outputs which were determined by change in net farm income between 1964 and 1965. Rolloff's data showed that participants in the instructional program realized an average of $53.16 net farm income for each $1 cost of the instructional program. In an additional related study of the relationship of selected educational variables to farm success, Persons (1966) found that farmers' enrollment in adult classes was significantly related both to gross income and gain in net worth.

Additional Research

Gibson (1967) is currently conducting a cost-benefit analysis of vocational-technical education in the area schools of Kentucky. LeRoy Peterson, Center for Studies in Vocational and Technical Education, University of Wisconsin, has begun a project to determine the costs of vocational-technical education programs. The instruments developed are to be tested in the Kenosha (Wisconsin) Vocational and Technical School. The study reported by Kaufman et al. (1967) is continuing with a final report of the project due in the fall of 1968.

REPORTS OF RESEARCH: COSTS AND BENEFITS OF MANPOWER TRAINING PROGRAMS

In comparison with studies on the economics of vocational-technical education in the public schools, there has been considerable research following cost-benefit and cost-effectiveness models pertaining to an economic evaluation of manpower training and retraining programs. Manpower development programs conducted under the provisions of the Area Redevelopment Act, the Manpower Development and Training Act, and related programs conducted under the provisions of state legislation have been investigated by economists. The more recent research and study in this area has concentrated on an evaluation of training programs for the disadvantaged, particularly the hard core unemployed.

This section of the report includes a general overview of the conceptual and methodological framework within which these evaluative studies have been conducted. Also, a general summary of the findings of this research is reported. Vocational educators contemplating research on the economics of vocational-technical education should familiarize themselves with the research and writings cited in this section which analyze the benefits and costs of training programs.

Methodological Framework for Evaluating Training Programs

In an economic evaluation of training and retraining programs, the cost of training is seen as a long-term investment in human beings, and like education in general, it is quite probable that this investment will yield substantial future returns. Somers (1965a) reminded those who assess training programs through an evaluation of human investment that labor is really not a commodity or a piece of equipment, hence the most important gains, costs, and returns of the retraining investment may be neither monetary nor quantifiable.

Mangum (1967a) stated that no federal manpower program currently has a reporting system that yields the kind of quality or data needed for meaningful evaluations of training programs. He emphasized also that many of the benefits and some of the costs of training programs are nonquantifiable thereby leaving broad areas of evaluation to assumption and judgment. Mangum (1967a) listed some technical problems in the application of cost-benefit techniques to a valid assessment of training programs. Although not challenging cost-benefit analysis conceptually, he cited several examples of types of considerations

that question the current usefulness of cost-benefit analysis in evaluating social programs.

Somers (1965b) pointed out that if oversimplified and misleading assumptions are to be avoided in assessing returns to training programs, it is important to have a long period of follow-up in calculating the rate of return. He also pointed out the crucial need to compare trainees with control groups in order to arrive at sound conclusions concerning the values of retraining. Weisbrod (1966a) argued that evaluation techniques are more likely to be useful if they are developed in relationship to theoretical concepts so that strengths and limitations of empirical techniques can be recognized. Weisbrod's (1966a) discussion of the conceptual issues in evaluating training programs should be read carefully by those planning and conducting research on the economics of occupational education programs.

Mangum (1967a) categorized the cost-benefit studies of manpower development and training programs into two types: a.) those which compared the pre-training and post-training employment and earnings of trainees and then estimated the time period necessary for the higher earnings and tax payments to pay back the public investment, and b.) those which compared the post-training employment and earnings of those completing training with a comparable control group who were not trained.

Control group designs used in cost-benefit studies of training programs are illustrated in the studies conducted by Somers (1965b), Solie (1968), Somers and Stromsdorfer (1964), Borus (1964), and Austin and Sommerfeld (1967). Somers (1965b) and Solie (1968) used four subgroups in assessing the effects of retraining programs: a.) those who completed the training program, b.) those who applied for and were accepted into the training program but did not report for training or dropped out before the completion of training, c.) those who applied for but were rejected for training, and d.) a sample of workers (from the immediate area of the trainees) who were unemployed at the time selections were made but who did not apply to enter the training program. Somers and Stromsdorfer (1964) used a similar pattern of comparison but expanded the number of groups to five by dividing the group designated by b.) above into those who started training but dropped out before completion and those who were accepted for training but did not report.

In Borus' (1964) study workers completing training who were placed in jobs which utilized the skills

taught in the retraining program were compared to workers who completed training but did not utilize skills taught in the retraining program, to workers who withdrew from the training program without employment, and to workers who refused to enter the training program without employment. Austin and Sommerfeld's (1967) appraisal of a manpower training program for disadvantaged youth involved comparisons between those trainees who stayed at the training center four months or longer with those persons who were tested but never entered the training program or who entered the training program but dropped out during the first three months of training.

Somers (1965a) presented a detailed discussion of the criteria for evaluating the benefits of training programs. He pointed out that benefits from training should be evaluated in terms of the trainee's gains in productivity relative to his own level of productivity prior to training and relative to the nontrainee. Due to the difficulties encountered in obtaining direct measures of gain in skill and productivity, the more frequently used indices of benefits of training programs are gains in employment and gains in earnings. Somers (1965a) emphasized that gains to society resulting from training programs were not readily documented or evaluated. He cited as an example the fact that a reduction in unemployment of a particular group of trainees does not necessarily imply that the training program has reduced total employment since a probable outcome may be simply a change of faces in the total group of unemployed persons. Weisbrod (1966a) discussed this and other issues which should be considered in measuring the benefits of training programs. The studies of Solie (1968), Somers and Stromsdorfer (1964) and Borus (1964) should be reviewed for specific indices used in assessing the benefits of training programs.

Somers (1965b) emphasized that when those successfully completing training programs experience an advantage in the labor market over comparison groups, the conclusion is not certain that the more advantageous labor market record is the result of the training program. Differences in the labor market performance between trainees and nontrainees may be due to differences in age, sex, race, education, and a variety of other socio-demographic variables. In some cases the counseling provided trainees or greater efforts on the part of the employment service in securing employment for trainees may account for a significant portion of the advantage in labor market performance held by the trainee. Multiple regression techniques have been used by most investigators in an effort to control for

differences in training that may be a result of differences between trainees and nontrainees in socio-demographic and situational characteristics (Borus, 1964; Somers and Stromsdorfer, 1964; Solie, 1968; Stromsdorfer, 1968).

With the recent interest in the evaluation of new programs oriented specifically toward the hard core unemployed and disadvantaged groups, the question has been raised whether these programs can be analyzed with the same cost-benefit procedures that have been used in assessing the effectiveness of regular training programs conducted under the provisions of the Area Development Act and the Manpower Development and Training Act. Sewell (1967) hypothesized that it was totally incorrect to generalize from the cost-benefit analyses that have been performed on manpower development and training programs to training schemes dealing with the target population of the War on Poverty. Sewall's argument in support of that hypothesis included an examination of the technical shortcomings of the published studies that applied cost-benefit techniques to an assessment of training programs. Cain and Somers (1967) contended that the general framework of cost-benefit analysis is appropriate for evaluating the more recent training and retraining programs but that its application to these training programs will be more difficult.

Findings of Research

Mangum (1967a) reported that his analysis of the cost-benefit studies of manpower development and training programs revealed data that are consistent enough and the margins of benefits over costs sufficiently large to leave little doubt but that the training programs have been a good economic investment. He concluded that there appeared to be little reason for questioning the worthwhileness of the Manpower Development and Training Act programs for its objectives have been justifiable social goals and its benefits have exceeded its costs by substantial margins. Main (1968) interviewed a national probability sample of Manpower Development and Training Act trainees and other persons who were employed about the same time the training courses started to learn whether training had any effect on income and employment during the period following training. He found, among those persons who held a full-time job since the training period, that both those who had completed training and the nontrainees earned about the same weekly wages on their most recent full-time jobs. However, more persons who had completed training than nontrainees were employed when interviewed.

Main (1968) concluded that the Manpower Development and Training Act programs increased employment even if better paying jobs did not result. Besen, Flechter, and Fisher (1967) analyzed several of the cost-benefit studies pertaining to manpower training programs and pointed out some of the limitations of the findings of the studies.

Page's (1964) analysis of retraining programs for 907 trainees in Massachusetts revealed that a total training cost of $630,000 could be expected to yield benefits of approximately $3,300,000 over the working life of the trainees. Borus' (1964) study of retraining programs in Connecticut showed that the benefits of retraining were considerably greater than the costs. Borus found that the government's and the economy's benefit-cost ratios for the training program were much greater than the individual worker's ratio. Borus (1964) concluded that the government should continue to sponsor retraining programs.

Somers and Stromsdorfer (1964) studied the economic aspects of manpower training programs in West Virginia. They found that trainees enjoyed notable advantages in employment and earnings relative to comparable non-trainees. For the average male trainee, Somers and Stromsdorfer found that the costs of retraining were quickly repaid in increased earnings and that high capital values and rates of return followed the retraining investment both for the trainee and for society. They concluded that there is evidence that the present and future benefits of manpower retraining substantially outweigh the costs. An additional report of this research has been made by Stromsdorfer (1968). Solie's (1968) study of training programs in two Appalachian counties in Tennessee revealed that retraining programs improved the employment experience of unemployed workers. The study yielded evidence which suggested also that at least a part of the improved employment status of trainees may have come at the expense of nontrained workers and that the benefits of retraining may be rather short-lived consisting principally of facilitating a rapid return to gainful employment of unemployed workers. A cost-benefit analysis of a basic and vocational education program for disadvantaged youth in Muskegon, Michigan, showed that benefits accruing to the 187 trainees in the experimental group could amount to approximately $500,000 over the working life of the trainees (Austin and Sommerfeld, 1967).

Somers (1965a, 1965b) concluded that training and retraining are a sound investment both for the trainees and for society. He commented that if the social-

psychological benefits accruing from an unemployed worker's return to the active labor market are added then there is little doubt but that the benefits heavily outweigh the costs of retraining.

Other research designed to assess the effectiveness of training programs has been completed which did not use a cost-benefit analysis design. Brazziel's (1966) experimental study comparing a combined instructional program of general education and technical training versus technical training alone revealed that general education in the curriculum contributed to a more rapid development of technical competencies in trainees, a higher incidence of employment, and a greater amount of earning power. Follow-up studies of trainees of Manpower Development and Training Act programs consistently reveal the post-training employment status of trainees to be improved over their pre-training employment status (Johnson, 1967; London, 1967; Miller and Zeller, 1967; Silverman, 1967). Gough and Rowe (1968) found that Manpower Development and Training Act programs for farmers and farm workers were a sound investment in education.

OTHER INDICES OF ECONOMIC BENEFITS

There is a considerable amount of research in vocational-technical education which has both direct and indirect implications concerning the economics of vocational-technical education. This research has as its main focus the evaluation of the effectiveness of vocational-technical education. The design of this research is primarily descriptive in nature yet cannot be categorized as fitting into a cost-benefit or cost-effectiveness model. In this section of the report, research will be reviewed which pertain to two topics that have direct implications concerning the economic benefits of vocational-technical education. These topics are the follow-up of students and the relationship between vocational education and the prevention of dropouts.

Follow-up Studies

Vocational educators maintain that one of the best techniques of evaluation is the follow-up of graduates to determine the extent to which they are placed and succeed in the occupations for which they were trained (Brandon and Evans, 1965). The U. S. Office of Education, through state departments of education, conducts annual surveys to determine the occupational status in October of those persons who have completed vocational-

technical education programs earlier in the year. Duis and Sanders (1968) reported that in October 1966, 96 percent of those persons available for employment who had completed full-time high school and post-high school programs in 1966 were employed. Of those available for employment, 80 percent were employed full-time in jobs for which they were trained or in a related field, 12 percent were employed full-time in jobs not related to their education, and 4 percent were employed part-time. Slightly over one-third of the students completing training programs were not available for employment either because they entered the armed forces, continued school full time, were unable to work, or did not want to work. Complete data indicating the employment status of persons completing full-time vocational programs in 1966 were reported by the Advisory Council on Vocational Education (1968b). Data were presented for persons completing programs in vocational agriculture, distributive education, health, home economics, office occupations, technical education, and trades and industry.

Eninger (1965) surveyed a nationwide sample of some 10,000 male graduates of high school trade and industrial vocational programs. Included in the sample were graduates of classes in 1953, 1958, and 1962. The study involved a comparison of vocational graduates with academic-course graduates. The salient findings of the study included the following: a.) academic course graduates required, on the average, one month longer to find their first full-time job than vocational graduates; b.) when equated for college education, the vocational graduates had significantly greater employment security than academic graduates (employment security was expressed as the percentage of time spent in full-time employment); c.) vocational graduates had significantly greater employment stability than academic graduates (employment stability was expressed as the average duration in months of employment per job held); d.) vocational graduates did not do as much moving from employer to employer; e.) when graduates without college education were compared, there was no significant difference in first-job starting hourly earnings between academic and vocational graduates; f.) vocational graduates working in the trades studied in high school tended to earn more than those working in trades that differed from their high school study; and g.) when graduates with no college education were compared, vocational graduates had higher earnings two and six years after graduation than academic graduates, but the academic graduates' earnings after eleven years out of school were equal to the vocational graduates' earnings. Davie (1967, 1968) used the data in Eninger's (1965) study to estimate differences

between the present value of total earnings for vocational graduates and academic graduates who did not attend college.

Kaufman, Schaefer, Lewis, Stevens, and House (1967) conducted a study involving interviews with over 5,000 high school graduates who had completed either a vocational, general, or academic curriculum. They reported that comparisons among the three groups on various measures of job experiences revealed that graduates of all three curricula tended to earn about the same amount of money, to remain on jobs for about the same length of time, to leave jobs for much the same reasons, and to have about the same levels of job satisfaction. Kaufman, Schaefer et al. (1967) concluded that a clear case could not be made that vocational education has a direct payoff in the occupational experiences of its graduates.

Numerous follow-up studies have been made of the graduates of the various instructional programs in vocational-technical education. Warmbrod and Phipps (1966) reviewed studies relating to graduates of programs of vocational education in agriculture; Lanham and Trytten (1966) reviewed follow-up studies of graduates in business and office occupations education; Meyer and Logan (1966) reviewed follow-up studies of graduates in distributive education; Larson (1966) reviewed follow-up studies of graduates in technical education; and Tuckman and Schaefer (1966) reviewed follow-up studies of graduates in trade and industrial education.

Sharp and Krasnegor (1966) sought to assess the value of follow-up studies as a measure of program effectiveness in vocational education. They concluded that follow-up studies of vocational education program graduates have demonstrated to be useful tools in the evaluation of programs of instruction and should be used in future program assessment. Sharp and Krasnegor (1966) recommended that the most productive design for follow-up studies was a combination trend and cohort study. Such a design allows a comparison of vocational graduates in a given year with nonvocational graduates and conducting follow-up studies at different times provides a clearer picture of the effect of training over an extended period of time.

Kaufman, Schaefer et al. (1967) recommended that more comprehensive data be gathered in follow-up studies. They contended that evaluation of vocational education programs involved more than determining the number of graduates who hold jobs that are related to their training. They proposed that the effectiveness

of school training is most clearly seen in the first job held after graduation, for in subsequent jobs it is difficult to assess the relative influence of training and post-high school work experience. Somers (1968a) critically reviewed the use of follow-up studies of vocational graduates and offered suggestions for the design of these studies.

Vocational Education and Dropouts

Another measure of the effectiveness of vocational education is its "holding power" for students. The proponents of vocational education contend that meaningful programs of vocational education tend to keep students, including the potential dropout, in school. Others argue that the alleged higher retention rate of the nonacademically inclined student which is claimed for vocational education has not been proven (Mangum, 1967b). The research relating directly to this problem is meager and, at best, inconclusive.

Boggs (1967) evaluated several curricular approaches for rehabilitating school dropouts through measures of vocational success of the students during the year immediately following the conclusion of training. The groups compared were persons who received vocational skill training in combination with academic training, persons who received vocational skill training only, persons who received academic training only, and persons who received no training or who dropped out of the program before completing 15 percent of the required course of study. Boggs found that persons who received a combined vocational and academic program and persons who received vocational skill training only experienced the greatest degree of vocational success during the first year following training.

Karnes (1966) evaluated the effectiveness of a prevocational curriculum which was designed to rehabilitate slow learners who were prone to become school dropouts, delinquents, and unemployed. Slow learners in the experimental group were matched with students in a conventional curriculum who served as a control group. The duration of the program was two years. Sixty-one pairs of students were included in the final analysis. Karnes found that students in the experimental group differed significantly from the control group in that students in the experimental group a.) had better attendance records and fewer school dropouts, b.) did less "job hopping" during the project years, and c.) continued in greater numbers their training on the job or in trade schools. Karnes (1966) concluded that educational programs for slow learners who are

dropout prone should be functional, individualized, and vocationally oriented; should include a progressive work program as the focal point of the curriculum; and should include academic work which stresses learnings which promote the acquisition of knowledge and skills needed to insure vocational success.

Kaufman, Lewis, and Gumpper (1968) compared the effectiveness of two educational programs for high school dropouts. A special program which provided the preparation necessary to qualify for a high school diploma was compared to a program that provided skill training only. All data indicated the diploma program was the more successful. The retention rate for the diploma program was more than double that of the skill program. Test results showed that the diploma graduates improved their reading and arithmetic skills while the skill training graduates did not, and the measures of self-esteem showed this same differential pattern. Kaufman, Lewis, and Gumpper (1968) concluded that all the available data pointed to the difference in the attitudinal tone or "atmosphere" of the two programs as one of the major reasons for the difference in their relative success. The attitudinal tone of the diploma program was supportive and accepting; that of the skill training program was not. The investigators reported that the difference in attitudinal tone between the two programs appeared to stem largely from the different attitudes of the programs' administrators toward the value of the programs.

There has been little research reported which investigated the costs and benefits of programs designed to prevent dropouts. Both Weisbrod (1965) and Corazzini (1966) reported case studies indicating that costs of preventing dropouts exceeded the estimated monetary benefits from the program. Weisbrod (1965) pointed out that few of the educational programs for preventing dropouts are designed to permit an assessment of their effectiveness. He maintained that without such information, cost-benefit analysis of programs designed to prevent dropouts is seriously handicapped.

CONCLUSIONS AND RECOMMENDATIONS

The research of economists indicates clearly that education is a vital element in economic growth and that investment in education yields a relatively high rate of return both to the individual and to society.

It is within the theoretical framework of the economics of education that research on the economics of vocational-technical education must be conducted.

Underlying the research on the economics of education in general and the economics of vocational-technical education specifically is the question of allocation of resources. Not only is the allocation of resources to the educational sector of interest, but of equal interest and importance is the allocation of resources within the educational sector.

Research on the economics of vocational-technical education is essential if adequate data are to be available for making informed decisions concerning the allocation of resources to occupational education. Data pertaining to the economics of vocational-technical education will bear heavily on policy decisions about occupational education including the question of what agencies, public schools or otherwise, can conduct occupational education programs most efficiently. If vocational educators want to be involved in the important policy decisions concerning vocational-technical education, they must become familiar with the research and concepts of cost-benefit analysis, cost-effectiveness analysis, and planning-programming-budgeting systems. These new systems are likely to increase in importance in the planning and evaluation of vocational-technical education programs.

Cost-benefit and cost-effectiveness studies of public school programs of vocational-technical education are just beginning. The findings of the research reported to date are inconclusive. Studies that are well designed indicate, however, that vocational-technical education is a sound investment. Cost-benefit and cost-effectiveness studies of manpower training and retraining programs demonstrate consistently the economic value of this type of occupational education.

The usefulness of cost-benefit analysis as an evaluative technique in vocational-technical education is limited by its requirement that benefits as well as costs be quantitated in monetary terms. The more appropriate technique for evaluating vocational-technical education is cost-effectiveness analysis which allows noneconomic as well as economic benefits to be related to costs of educational programs. The research and writings reviewed in this report indicate that there is neither adequate cost nor benefit data presently available for meaningful analyses of vocational-technical education. Vocational educators can make a worthwhile contribution to realistic appraisals of vocational-technical education by identifying appropriate cost and performance criteria for use in cost-effectiveness analysis.

Research conducted by vocational educators relating directly or indirectly to the economic value of vocational-technical education has been primarily descriptive rather than analytical. Research conducted by economists relating to the economics of vocational-technical education has been limited in scope and concept, particularly in the identification and measurement of the benefits of vocational-technical education. Research pertaining to the effectiveness of vocational-technical education would be enhanced by greater joint efforts on the part of vocational educators and economists. Vocational educators can make significant contributions in designing and conducting research pertaining to the economics of vocational-technical education.

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